EXHIBIT C

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May 6, 2010

REMEDIAL INVESTIGATION FOR OPERABLE UNIT 3 LIBBY ASBESTOS SUPERFUND SITE

PHASE IV SAMPLING AND ANALYSIS PLAN PART A – DATA TO SUPPORT HUMAN HEALTH RISK ASSESSMENT

Prepared by
U.S. Environmental Protection Agency
Region 8
Denver, CO

With Technical Assistance from:

SRC, Inc.
Denver, CO

APPROVAL PAGE

This Phase IV Part A Sampling and Analysis Plan for Operable Unit 3 of the Libby Asbestos Superfund Site is approved for implementation.

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Bonita Lavelle Date
Remedial Project Manager, Libby OU3

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DOCUMENT REVISION LOG

Revision	Date	Primary Changes
0	05/06/2010	--

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LIST OF ACRONYMS

ABS	Activity-Based Sampling
AOC	Administrative Order on Consent
ATV	All Terrain Vehicle
CAR	Corrective Action Request
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chain-of-Custody
CSM	Conceptual Site Model
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
EDXA	Energy Dispersive X-Ray Analysis
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
FSRZ	Fire Suppression Restricted Zone
FSDS	Field Sample Data Sheets
FSP	Field Sampling Plan
FTP	File Transfer Protocol
GIS	Geographic Information System
GO	Grid Opening
GPS	Global Positioning System
GSD	Geometric Standard Deviation
ID	Identification number
IL	Inter-laboratory
ISO	International Organization for Standardization
IUR	Inhalation Unit Risk
KDC	Kootenai Development Corporation
LA	Libby Amphibole
MCE	Mixed Cellulose Ester
MDEQ	Montana Department of Environmental Quality
MWH	MWH Americas, Inc
NVLAP	National Voluntary Laboratory Accreditation Program
OU	Operable Unit
PCM	Phase Contrast Microscopy
PCME	Phase Contrast Microscopy Equivalent
PDF	Portable Document Format
PLM	Polarized Light Microscopy
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control

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RBC	Risk-Based Concentration
RBF	Risk-Based Fraction
RD	Recount Different
RI	Remedial Investigation
RPM	Remedial Project Manager
RS	Recount Same
SAED	Selective Area Electron Diffraction
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TEM	Transmission Electron Microscopy
TWF	Time-Weighting Factor
UCL	Upper Confidence Limit
USFS	U.S. Forest Service

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**REMEDIAL INVESTIGATION
FOR OPERABLE UNIT 3
LIBBY ASBESTOS SUPERFUND SITE**

**PHASE IV SAMPLING AND ANALYSIS PLAN
PART A – DATA TO SUPPORT
HUMAN HEALTH RISK ASSESSMENT**

1.0 PROJECT OVERVIEW

1.1 Purpose of This Document

This document is the Sampling and Analysis Plan (SAP) for Phase IV Part A (Data to Support Human Health Risk Assessment) of the Remedial Investigation (RI) for Operable Unit 3 (OU3) of the Libby Asbestos Superfund Site (the site). This SAP contains the elements required for both a field sampling plan (FSP) and quality assurance project plan (QAPP), and has been developed in accordance with the U.S. Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans (EPA 2001) and the Guidance on Systematic Planning Using the Data Quality Objectives Process – EPA QA/G4 (EPA 2006). The SAP is organized as follows:

Section 1 – Project Overview
Section 2 – Background and Problem Definition
Section 3 – Data Needed For Human Health Risk Assessment
Section 4 – Data Quality Objectives
Section 5 – Sampling Program
Section 6 – Laboratory Analysis Requirements
Section 7 – Quality Control
Section 8 – Sample Handling & Documentation
Section 9 – Data Management
Section 10 – Assessment and Oversight
Section 11 – Data Validation and Usability
Section 12 – References

1.2 Project Management and Organization

<u>Project Management</u>

EPA is the lead regulatory agency for Superfund activities within OU3. The EPA Remedial Project Manager (RPM) for OU3 is Bonita Lavelle, EPA Region 8. Ms. Lavelle is a principal data user and decision-maker for Superfund activities within OU3.

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The Montana Department of Environmental Quality (MDEQ) is the support regulatory agency for Superfund activities within OU3. The MDEQ Project Manager for OU3 is Dick Sloan. EPA will consult with MDEQ as provided for by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the National Contingency Plan, and applicable guidance in conducting Superfund activities within OU3.

EPA has entered into an Administrative Order on Consent (AOC) with Respondents W.R. Grace & Co.-Conn. and Kootenai Development Corporation (KDC) for performance of a Remedial Investigation/Feasibility Study (RI/FS) at OU3 of the Libby Asbestos Site. Under the terms of the AOC, W.R. Grace & Co.-Conn. and KDC will implement this SAP. The designated Project Coordinator for Respondents W.R. Grace & Co.-Conn. and KDC is Robert Medler of Remedium Group, Inc.

<u>Technical Support</u>

EPA will be supported in this Phase IV RI by a number of contractors, including:

- SRC, Inc. will assist in the development of SAPs, and in the evaluation and interpretation of the data.
- Formation Environmental, Inc., a contractor to SRC, will provide support in planning sampling and analysis activities, preparation of maps and other geographic information system (GIS) applications needed to summarize and interpret data, maintenance of a web site with site data, and evaluation of the feasibility study.
- HDR will provide oversight of field sampling and data collection activities.
- The U.S. Department of Transportation, John A. Volpe National Transportation Systems Center will implement the laboratory quality assurance (QA) program for OU3 and provide technical support.

<u>Field Sampling Activities</u>

All field sampling activities described in this SAP will be performed by W.R. Grace & Co.-Conn. and KDC, in strict accord with the sampling plans developed by EPA. W.R. Grace & Co.-Conn. and KDC will be supported in this field work by MWH Americas, Inc. (MWH) and by their subcontractor Chapman Construction, Inc. Individuals responsible for implementation of field sampling activities are listed below:

- Project Manager: John Garr
- Field Team Leader:
- Field Quality Control Officer:
- Quality Control Officer:

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On-Site Field Coordinator

Although most of the work described in this Phase IV SAP will be conducted on property owned by the US Forest Service (USFS), crews may need to access areas of OU3 via Rainy Creek Road. Access to the mine via Rainy Creek Road is currently restricted and is controlled by EPA. The on-site point of contact for access to the mine is Rob Burton of PRI:

Rob.burton@priworld.com
406-293-3690

Sample Preparation and Analysis

All samples collected as part of the Phase IV investigation will be sent for preparation and/or analysis at laboratories selected and approved by EPA. Laboratories that will be utilized for analysis of Phase IV asbestos samples include (insert names of selected laboratories in final SAP)

Data Management

Administration of the master database for OU3 will be performed by EPA contractors (SRC and Formation Environmental). The primary database administrator will be Lynn Woodbury of SRC. She will be responsible for sample tracking, uploading new data, performing data verification and error checks to identify incorrect, inconsistent or missing data, and ensuring that all questionable data are checked and corrected as needed. When the OU3 database has been populated, checked and validated, relevant asbestos data will be transferred into a Libby Asbestos Site database as directed by EPA for final storage.

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2.0 BACKGROUND AND PROBLEM DEFINITION

2.1 Site Description

Libby is a community in northwestern Montana that is located near a large open-pit vermiculite mine. Vermiculite from the mine at Libby is known to be contaminated with amphibole asbestos that includes several different mineralogical classifications, including richterite, winchite, actinolite and tremolite. For the purposes of EPA investigations at the Libby Asbestos Superfund Site, this mixture is referred to as Libby Amphibole (LA).

Historic mining, milling, and processing of vermiculite at the site are known to have caused releases of vermiculite and LA to the environment. Inhalation of LA associated with the vermiculite is known to have caused a range of adverse health effects in exposed humans, including workers at the mine and processing facilities (Amandus and Wheeler 1987, McDonald et al. 1986, McDonald et al. 2004, Sullivan 2007, Rohs et al. 2007), as well as residents of Libby (Peipins et al. 2003). Based on these adverse effects, EPA listed the Libby Asbestos Site on the National Priorities List in October 2002.

Starting in 2000, EPA began taking a range of cleanup actions at the site to eliminate sources of LA exposure to area residents and workers using CERCLA (or Superfund) authority. Given the size and complexity of the Libby Asbestos Site, EPA designated a number of Operable Units (OUs). This document focuses on investigations at OU3. OU3 includes the property in and around the former vermiculite mine and the geographic area surrounding the mine that has been impacted by releases and subsequent migration of hazardous substances and/or pollutants or contaminants from the mine, including ponds, Rainy Creek, Carney Creek, Fleetwood Creek, and the Kootenai River. Rainy Creek Road is also included in OU3.

Figure 2-1 shows the location of the mine and a preliminary study area boundary for OU3. EPA established the preliminary study area boundary for the purpose of planning and developing the scope of the remedial investigation/feasibility study (RI/FS) for OU3. This study area boundary may be revised as data are obtained during the RI for OU3 on the nature and extent of environmental contamination associated with releases that may have occurred from the mine site. The final boundary of OU3 will be defined by the final EPA-approved RI/FS.

2.2 Basis for Concern

EPA is concerned with environmental contamination in OU3 because the area is used by humans for logging, a variety of recreational activities, and in the case of USFS employees, land management and fire fighting activities. The area is also habitat for a wide range of ecological receptors (both aquatic and terrestrial). Contaminants of potential concern to EPA in OU3

include not only LA, but any other mining-related contaminants that may have been released to the environment.

2.3 Scope and Strategy of the RI at OU3

As noted above, Respondents W.R. Grace & Co.- Conn. and KDC are performing an RI in OU3 under EPA oversight in order to characterize the nature and extent of environmental contamination and to collect data to allow EPA to evaluate risks to humans and ecological receptors from mining-related contaminants in the environment.

The RI is being performed in several phases. Phase I of the RI was performed in the fall of 2007 in accord with the *Phase I Sampling and Analysis Plan for Operable Unit 3* (EPA 2007). The primary goal of the Phase I investigation was to obtain preliminary data on the levels and spatial distribution of asbestos and non-asbestos contaminants that might have been released to the environment in the past as a consequence of the mining and milling activities at the site.

Phase II of the OU3 RI was performed in the spring, summer, and fall of 2008. Phase II was composed of three parts, as follows:

- Part A (EPA 2008a) focused on the collection of data on the levels of LA and other chemicals of concern in surface water and sediment, as well as site-specific toxicity testing of surface water using rainbow trout.
- Part B (EPA 2008b) focused on the collection of data on LA levels in ambient air samples collected near the mined area, and on the collection of data on LA and other chemicals of potential concern in groundwater.
- Part C (EPA 2008c) focused on the collection of other data needed to support the ecological risk assessment at the site.

Phase III of the RI was performed primarily in the spring, summer, and fall of 2009, with some activities still ongoing. The details of the plan are provided in EPA (2009a). Phase III included the collection of activity-based air samples during simulated recreational visitor activities in the forested area, as well as the collection of a variety of ecological community and habitat metrics in support of the ecological risk assessment, toxicity testing of surface water using rainbow trout, and toxicity testing of surface water and sediment using amphibians.

2.4 Scope and Purpose of the Phase IV SAP

The Phase IV SAP describes the sampling and analysis that will be performed during Phase IV of the OU3 RI. This document (Phase IV, Part A) describes the activities planned to collect data to support the human health risk assessment. The details of data collection in support of the ecological risk assessment are provided in Part B of the Phase IV SAP.

3.0 DATA NEEDED FOR HUMAN HEALTH RISK ASSESSMENT

3.1 Conceptual Model for Human Exposure to Asbestos

Figure 3-1 presents a conceptual site model (CSM) for human exposure to asbestos that summarizes EPA's current understanding of the environmental media in OU3 that are likely to be contaminated by past and ongoing releases of LA from the mine, and the pathways by which humans might be exposed to LA, now or in the future. The CSM for LA focuses on pathways of inhalation exposures, because the inhalation pathway is generally considered to be of much greater risk than oral or dermal pathways for human exposure. The CSM has been revised since the Phase III SAP was implemented based on EPA's revised understanding of human activities that are reasonably expected to occur within OU3.

A range of different human receptors may be exposed to LA in OU3, including:

- *Trespasser or "rockhound" in the mined area* – This population includes older children and adults who trespass on the area that has been disturbed by past mining activities. In this document, this is referred to as the "mined area". Exposures of potential concern for asbestos include inhalation of ambient air and inhalation of air in the vicinity of soil, duff, and solid waste (e.g., tailings, ore) disturbances.

- *Recreational visitors in the forested area* – This receptor population includes older children (assumed to be age 7 or older) and adults who engage in activities such as camping, hiking, dirt bike riding, all terrain vehicle (ATV) riding, hunting, etc. Exposures of primary concern for asbestos include inhalation of ambient air, inhalation of air in the vicinity of contaminated soil, duff (organic debris), or roadways/trails disturbed by recreational activity, and inhalation of LA released from contaminated tree bark while gathering wood for a campfire and while burning the wood in a campfire.

- *Recreational visitors along streams and ponds* – This receptor population includes adults and older children who hike, fish, wade/swim or explore site drainages, including the streams and ponds along Fleetwood Creek, Carney Creek, and Rainy Creek, as well as reaches of the Kootenai River that may be impacted by site releases. Exposures of potential concern for asbestos include inhalation of ambient air and inhalation of air in the vicinity of duff, dried soils or sediments that are disturbed by walking or exploring drainages. As noted above, exposure from ingestion of LA in fish is judged to be of minor concern compared to inhalation exposures that would occur during visits to OU3.

- *Residential wood harvester in the forested area* – This receptor population includes adult area residents who engage in sawing, hauling, and stacking wood for personal use.

Exposures of potential concern for asbestos in OU3 include inhalation of ambient air, inhalation of airborne emissions of LA from roadways and inhalation of air that contains LA released from soil or duff as well as LA fibers released to air by cutting and hauling timber that has LA in the tree bark.

- *Commercial loggers in the forested area* – This receptor population includes adult workers who are employed in commercial logging operations in OU3. Exposures of potential concern for asbestos include inhalation of ambient air, inhalation of airborne emissions of LA from roadways and inhalation of air that contains LA released from soil or duff as well as LA fibers released to air by cutting and stacking timber that has LA in the tree bark.

- *Forest service workers in the forested area* – This population includes employees of the U.S. Forest Service (USFS) who may engage in a range of forest management activities, including maintenance of roads and trails, cutting fire breaks, thinning and trimming trees, measuring trees, etc. Exposures of potential concern for asbestos include inhalation of ambient air, inhalation of airborne emissions of LA from roadways and inhalation of LA released to air from management activities that disturb soil, tree bark or duff.

- *Forest service fire fighters in the forested area* – This population includes employees of the USFS who respond to forest fires that occur within OU3. For ground-based fire fighters, exposures of potential concern include inhalation of ambient air, inhalation of LA released to air from disturbance of soil, duff, and treebark while performing activities such as cutting fire lines and , as well as inhalation of LA released to smoke by the fire. For pilots of aircraft that respond to fires in OU3, the exposure of concern is inhalation of LA that is released to smoke and that enters the aircraft as it passes through the smoke column.

- *Area residents* – Area residents who do not enter OU3 are not likely to be exposed to LA from OU3 except via inhalation exposure to LA released into air during a forest fire.

Note that other residential exposure scenarios are not included in the CSM for OU3 because any properties geographically within OU3 that are currently residential will be evaluated for routine residential scenarios as part of OU4. Based on information currently available to EPA, future residential development is not reasonably anticipated in other areas of OU3.

Pathways Selected for Quantitative Investigation in Phase IV

Not all of the exposure scenarios to asbestos identified in Figure 3-1 are of equal concern or require equal levels of investigation. The following sections identify the pathways of chief concern to EPA and which are considered to warrant quantitative evaluation in the human health risk assessment.

Exposure to Ambient Air

All people who are present in OU3 may be exposed to LA in ambient air. Therefore, this pathway is selected for quantitative evaluation. Data to support the evaluation of exposure to ambient air was collected in the Phase I and Phase II RI.

Exposures of Trespasser/Rockhound within the Mined Area

The mined area is characterized by the occurrence of vermiculite interspersed with veins of LA exposed by mining, as well as large piles of mine waste, waste rock, and a coarse tailings pile. Sampling results from the Phase I remedial investigation at OU3 indicate that levels of LA greater than 1% occur at multiple locations in the mined area. The Phase I sampling results, along with observations of veins of LA exposed by mining , provide sufficient information to conclude that sources present are very likely to be of concern to human health. EPA guidance contained in OSWER Directive 9200.0-68 ("Framework for Investigating Asbestos-Contaminated Superfund Sites", EPA 2008d), provides that "if data indicate high levels of asbestos are present in soil (e.g., >1%), a risk manager may determine that a response action should be undertaken and that further efforts to characterize the source or potential airborne exposures before action is taken are not needed." Therefore, EPA has concluded that response action is necessary to prevent human exposure to LA within the mined area of OU3. EPA anticipates that access restrictions to the mined area and adjacent lands surrounding the mined area that are owned by KDC (including the unpaved portion of Rainy Creek Road) will be part of an OU3 response action and that quantification of hypothetical future exposures of trespassers within this mined area and surrounding W.R. Grace-owned property is not needed to support risk management decision-making. EPA expects that alternatives to prevent human access to the mined area will be evaluated in the feasibility study for OU3.

Exposures of Recreational Visitors in the Forest Area

Recreational visitors who enter the forested area around the mine site may be exposed to asbestos during a wide variety of activities that disturb contaminated source media, including soil, duff, and tree bark. The reasonable maximum exposure includes:

- Inhalation exposure while walking or hiking
- Inhalation exposure while riding an ATV
- Inhalation exposure while actively disturbing soil or duff when clearing a campsite or building a fire
- Inhalation exposure when gathering wood with LA contamination in bark for a campfire
- Inhalation exposure to smoke from burning wood with contaminated bark in a campfire.

All of these activities are considered to be plausible and potentially important in evaluating human exposure in OU3, so all of these activities are selected for quantitative evaluation. Note that due to the steep terrain, camping occurs mainly on roadways or at the sides of roadways within OU3. Data to support the evaluation of these activities was collected in the Phase III RI.

Exposures of Recreational Visitors Along Ponds and Creeks

Sediments in ponds and creeks that drain OU3 are known to be contaminated with LA, and recreational visitors who disturb the sediments while walking or fishing along the ponds or creeks might be exposed to LA released to air. In this regard, release of LA from sediments that are submerged is not of concern, and release from sediments that are exposed but still wet is likely to be relatively low. However, releases from contaminated sediments that become exposed and dry out during periods of low water could be of concern. These activities are selected for quantitative evaluation. Data to support the evaluation of these activities will be collected in Phase IV RI, Part A.

Exposure of Commercial Loggers

The best approach for characterizing human exposure during this activity would be to monitor air levels during authentic commercial logging activities near the site. However, at present, commercial logging activities have been suspended in the area near the mine. EPA will consider the need to investigate this scenario in the future after consideration of the results for the other scenarios that will be evaluated.

Exposures of USFS Workers

USFS workers have the potential to be exposed to LA released from disturbed soil, duff and tree bark during a range of different forest management activities such as trail maintenance, tree thinning, and stand examination. These activities are selected for quantitative evaluation, and data to support the evaluation of these activities will be collected in Phase IV RI, Part A.

Exposures of USFS Workers and Firefighters

USFS firefighters have the potential to be exposed to LA released from disturbed soil, duff and tree bark when responding to wildfires in OU3. For ground-based firefighters, exposures of chief concern include cutting firelines by hand and with heavy equipment. For pilots who respond by air, the exposure of chief concern is inhalation of LA in smoke that enters the aircraft cockpit. These activities are selected for quantitative evaluation, and data to support the evaluation of these activities will be collected in Phase IV RI, Part A.

Exposures of Area Residents

Area residents who harvest wood for use as a heating source have the potential to be exposed to LA released from disturbed soil, duff, and tree bark. During a forest fire within OU3, area residents also have the potential to be exposed to LA released in smoke from burning trees. Data to support the evaluation of these activities will be collected in Phase IV RI, Part A.

3.2 Data Needs for Human Health Risk Assessment

As discussed in EPA (2008d), evaluation of risk to humans from inhalation exposure to asbestos requires reliable estimates of the long-term average concentration of asbestos in breathing zone air. At present, it is not possible to reliably calculate breathing zone air concentrations based only on knowledge of asbestos levels in source materials (soil, duff, tree bark, etc.), so the best approach is usually to obtain multiple direct measurements of asbestos in air for use in the risk assessment. This is generally referred to as Activity-Based Sampling (ABS), where the activities may range from passive (little or no disturbance of contaminated source materials) to a range of active disturbances of source materials. EPA guidance (2008d) recommends focusing on active disturbances of source materials to support Superfund risk management decisions.

To date, ABS data have been collected for the recreational visitor in forest area (during the Phase III RI). EPA believes that the ABS data collected for recreational visitors in the forest area during the Phase III RI adequately characterize some (e.g., inhalation of LA from disturbance of soil and duff while hiking/walking) but not all of the exposure pathways for the additional populations of potential concern, so it is concluded that additional ABS data are needed to support exposure and risk evaluations for other populations.

Therefore, the Phase IV investigation will seek to obtain adequate ABS data for five of the six populations of concern in OU3 for which no ABS data currently exist:

- Recreational visitors along streams and ponds
- Residential wood harvesters
- USFS workers
- USFS firefighters
- Area residents exposed to smoke from a forest fire

The potential need to perform ABS studies to represent exposures to commercial loggers in OU3 will be considered in the future, after review and evaluation of the Phase IV ABS data.

4.0 DATA QUALITY OBJECTIVES FOR PHASE IV ABS DATA COLLECTION

EPA has developed a seven-step process for establishing data quality objectives (DQOs) to help ensure that data collected during a field sampling program will be adequate to support reliable site-specific risk management decision-making (EPA 2001, 2006). These seven steps are presented below.

4.1 Step 1: State the Problem

The Phase I remedial investigation for OU3 of the Libby Asbestos Site included collection of data on levels of LA in tree bark, duff, and forest soils within the Kootenai National Forest surrounding the mined area. The Phase I data indicate that LA was detected by polarized light microscopy (PLM) in soils at distances up to 2 miles from the mine in the downwind direction. LA was detected by transmission electron microscopy (TEM) in samples of tree bark and duff in downwind, cross wind and upwind directions at distances from 3 to 7.5 miles from the mine. There is general tendency for the highest levels detected in tree bark and duff samples to occur within about 2 to 3 miles of the mined area. It's currently unknown whether the detected LA presents an unacceptable risk to human health.

As stated in the Framework for Investigating Asbestos-Contaminated Superfund Sites (EPA 2008d), asbestos fibers in source material are typically not inherently hazardous, unless the asbestos is released from the source material into air where it can be inhaled. If inhaled, asbestos fibers can increase the risk of developing lung cancer, mesothelioma, pleural fibrosis, and asbestosis.

EPA will perform an assessment of risk to human health from exposure to LA released from tree bark, soil and/or duff within the OU3 study area in order to decide whether remedial action is warranted and where. Evaluating risks to humans from exposure to asbestos is most reliably achieved by collection of data on the level of asbestos in breathing zone air during disturbance of a source of asbestos (i.e., ABS sampling) (EPA 2008d). Information on the level of LA in breathing zone air released from disturbed tree bark, soil, and duff is needed to complete a risk assessment for OU3. However, at present, there are no ABS data that are adequate to evaluate the exposures of recreational visitor along streams and ponds, residential wood harvesters in OU3, USFS workers and firefighters in OU3, or area residents exposed to smoke from fires in OU3.

4.2 Step 2: Identify the Goal of the Study

The goal of the Phase IV RI is to provide sufficient data to allow EPA to complete an exposure assessment for recreational visitors along streams and ponds, residential wood harvesters, USFS workers and firefighters in OU3 and area residents exposed to smoke from fires in OU3. EPA

will use the exposure assessment in an evaluation of risks to human health. The risk assessment will support decisions about whether or not response actions are needed to protect various sub-populations of humans from unacceptable risks from LA in air that is attributable to releases from human disturbances of contaminated environmental media in OU3 and releases resulting from fires.

4.3 Step 3: Identify Information Inputs

The information needed to characterize human exposures from activities in OU3 consists of reliable and representative measurements of LA concentrations in air under exposure scenarios that are characteristic of the activities engaged in by members of each of the populations of people described above. Such measurements are obtained by drawing a known volume of air through a filter that is located in the breathing zone of the individual performing the disturbance activity and measuring the number of LA fibers that become deposited on the filter surface.

The information needed to characterize exposure of area residents to LA in smoke from forest fires consist of reliable and representative measurements of LA in ambient air during a fire in the area of the forest impacted by LA.

4.4 Step 4: Define the Bounds of the Study

Spatial Bounds: The spatial bounds of the study include the OU3 study area identified in Figure 2-1. For each sub-population, exact sampling locations should include areas that are representative of the scenario being evaluated, as follows:

- Recreational visitors along streams and ponds. As noted above, EPA anticipates that access to land owned by W.R Grace and Co. will be restricted as part of a response action in OU3. This includes the area that encloses the tailings impoundment, the Mill pond, and Carney and Fleetwood Creeks. However, the lower portion of Rainy Creek below the boundary of the W. R. Grace-owned property may be open to recreational visitors. Based on this, the area of chief concern for this population is along lower Rainy Creek, from the W.R. Grace property line to the Kootenai River.
- Residential wood harvesters. This population of people may be exposed at any location within OU3 where wood harvesting is permitted by the USFS. Based on this, ABS sampling for the residential wood harvester scenario should occur at multiple areas within OU3. Available data on levels of LA measured in tree bark, soil and duff indicate that, in general, the levels of LA tend to decrease with distance away from the center of the mine. Since wood harvesting could occur anywhere within the forested area of OU3, ABS sampling to characterize exposures for the residential wood harvester should occur in areas where relatively high, average, and low levels of LA have been detected in tree bark, soil and duff.

- USFS workers. This population of people may be exposed at almost any location within OU3. Based on this, ABS sampling for the USFS worker populations should occur at multiple areas within OU3. ABS sampling to characterize exposures for USFS workers should occur in areas where relatively high, average, and low levels of LA have been detected in tree bark, soil and duff.
- USFS fire fighters. Based mainly on available data on LA levels in soil, duff and tree bark, the USFS has established a "fire suppression restricted zone" (FSRZ) around the mined area within which fire fighting is restricted to aerial attack. This FSRZ is the area that is of chief concern. ABS data are needed to evaluate the risk associated with fighting fires in this area using ground crews to determine the need for the FSRZ and if needed, the boundary. Also, ABS data are needed to evaluate the risk associated with fighting fires in this area using aerial attack. ABS sampling to characterize exposures for USFS fire fighters should occur in areas of relatively high, average, and low levels of LA that have been detected in tree bark, soil, and duff within the FSRZ.
- Area residents exposed to smoke. Area residents may be exposed to smoke from forest fires mainly in the community of Libby including residential areas around the perimeter of OU3. EPA (2009b) established three monitoring stations to measure LA in air during significant fire events, including a) the CDM office building in Libby, b) the campground east of OU3 at McGillvary Access, and c) the USFS ranger station along Highway 37. These three stations are reasonable and representative, and will be maintained for use in Phase IV. During a significant fire event, one additional mobile station will be established downwind of the fire.

Temporal Bounds: The release of LA from source materials (dried sediment, soil, duff, tree bark) into air is expected to depend on several factors that may tend to vary over time, including, for example, the moisture content of the source, the amount of ground cover, and the wind speed and direction when disturbance occurs. Therefore, ABS data should, to the extent practicable, be collected over a sufficient time frame to ensure the data are representative of the long-term mean concentration level. In general, it is expected that human exposures are more likely to occur when snow is limited or absent from OU3, and that releases will tend to be higher in the dry summer months than during wet conditions in spring or fall. Based on this, most of the ABS sampling events should occur in the time frame of June-October. To avoid collecting data that are biased low, ABS sampling should not occur during or within 1 day of rainfall (>1/4 inch). This approach will help ensure that the mean concentration calculated using the set of measurements obtained during dry periods is more likely to overestimate than underestimate the actual long term mean exposure.

4.5 Step 5: Define the Analytical Approach

The results of the ABS program in OU3 will be used to calculate an exposure point concentration for each population at each ABS location. The exposure point concentration will be the average air concentration measured over multiple rounds of sampling. Note that each round of ABS may

require the collection of several air samples collected during separate disturbance activities to avoid overloading the filters. In such cases, the exposure point concentration will be the average of all samples and all rounds of sampling. The data on ambient air concentrations during a forest fire will be used to calculate an exposure point concentration for residents.

The exposure point concentration will be combined with assumptions about exposure frequency and duration for each scenario and toxicity factors for LA in a baseline risk assessment for OU3 that is expected to provide a basis for EPA to determine, in consultation with MDEQ, whether response action is needed within OU3 to protect human health. EPA guidance contained in OSWER Directive 9355.0-30, "Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions" (EPA 1991) indicates that where the cumulative carcinogenic risk to an individual based on reasonable maximum exposure for both current and future land use is less than 1E-04 and the non-carcinogenic hazard quotient is less than 1, remedial action is generally not warranted unless there are adverse environmental impacts. The guidance also states that a risk manager may decide that a risk level lower than 1E-04 is unacceptable and that remedial action is warranted where there are uncertainties in the risk assessment results.

Human health risk will be calculated for each scenario at each ABS location. Ideally, there would be sufficient ABS locations to allow risks to be calculated at various distances from the mine and in all directions. However, this would require ABS sampling over an area of over 100 square miles. The approach that will be taken is to collect ABS samples in the predominantly downwind direction from the mine and to assume that the risks calculated at these locations are equal to or greater than the risks at equal distances from the mine in the crosswind and upwind directions. This approach will help ensure that assumed risks at locations in the up- and cross-wind directions are more likely to be overestimated than underestimated. If deemed to be needed to support risk management decisions, additional ABS at locations in the cross- and up-wind directions may be added in the future. Any additional will be specified in a modification to this SAP.

4.6 Step 6 – Specify Performance Criteria

In making decisions about the risks to humans in OU3, two types of decision errors are possible:

1. A false negative decision error would occur if a risk manager decides that exposure to LA in OU3 is not of health concern, when in fact it is of concern.
2. A false positive decision error would occur if a risk manager decides that exposure to LA in OU3 is above a level of concern, when in fact it is not.

EPA is most concerned about guarding against the occurrence of false negative decision errors, since an error of this type may leave humans exposed to unacceptable levels of LA in OU3. EPA guidance recommends that because of the uncertainty in estimating the true average concentration within an exposure area, the 95% upper confidence limit of the arithmetic mean

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(95UCL) should be used when calculating exposure and risk to humans. The 95UCL provides reasonable confidence that the true average will not be underestimated and controls false negative decision errors. In general, as the number of samples increases, uncertainties decrease, the value of the 95UCL moves closer to the true mean and exposure evaluations using either the mean or the 95UCL produce similar results. For this reason, it is anticipated that risk management decisions at OU3 will be based not only on the best estimate of the long-term average concentration at each ABS sampling area, but will also consider an estimate of the 95UCL at each ABS sampling area. Use of the 95 UCL to estimate exposure and risk at each exposure area helps account for limitations in the data, and provides a margin of safety in the risk calculations, ensuring that risk estimates are more likely to overestimate than underestimate the true risk level.

EPA is also concerned with the probability of making false positive decision errors. Although this type of decision error does not result in unacceptable human exposure, it may result in unnecessary expenditure of resources. For the purposes of this planning effort, the strategy adopted for controlling false positive decision errors is to seek to ensure that, if the risk estimate based on the best estimate of the mean is ≤ ½ the level of concern but the estimate based on the 95UCL is above EPA's level of concern, then the ratio of the risk estimates (risk based on the 95UCL divided by risk based on best estimate of the mean) is less than a factor of 3. For example, if the risk estimate based on the mean were 10% of the level of concern and the risk estimate based on the 95UCL were 50% of the level of concern (a ratio of 5), the data would be considered to adequate for decision-making. However, if the risk estimate based on the mean were 40% of the level of concern and the risk estimate based on the 95UCL were twice (200%) the level of concern (also a ratio of 5), then it would be concluded that there is a substantial probability of a false positive error and that more data may be needed to strengthen decision-making. Conversely, if the risk estimate based on the mean were 80% of the level of concern and the risk estimate based on the 95UCL were twice the level of concern (a ratio of 2.5), then it would be concluded that there is only a small probability of a false positive error and that collection of additional data would be unlikely to improve the basis for decision-making.

4.7 Step 7: Develop the Plan for Obtaining Data

Activities to be Included in the ABS

For each sub-population to be evaluated in Phase IV, there are a variety of different activities that might result in exposure to LA. Because the focus is on collecting data that are representative of the long-term average, the ABS scenario for each of the sub-populations will include activities that are considered to be realistic and representative for the population being assessed. These scenarios are described in "scripts" that are implemented by individuals who collect the ABS data. These scripts specify the types of activity to engage in, and the relative length of time for each activity. These scripts are provided in Attachment A.

Selection of Sampling Locations

Because of the very complex nature of the source material (a mixture of duff, soil, and tree bark), the difficulty in thoroughly characterizing the LA concentrations in these source media, and the potential difficulty in establishing a reliable quantitative relation between source and ABS air, no attempt will be made to establish a quantitative relation between LA levels in source media and the mean concentration in ABS air. Rather, ABS air data will be collected at multiple locations in OU3, selected to be representative of locations where the scenario of concern is likely to occur. This in turn yields information on the spatial pattern of exposure and risk.

The strategy for selection of sampling locations is based mainly on a consideration of spatial representativeness, and is also informed by available data on LA levels in source media (soil, duff and tree bark) as a function of distance and direction from the mined area. These data, collected along seven transects radiating from the mined area during the Phase I investigation, are summarized in Figure 4-1.

Figure 4-2 shows candidate ABS "study areas" for use during the Phase IV ABS program.

- For the recreational visitor along Rainy Creek, the ABS study area extends from the W.R. Grace-owned property south to the Kootenai River. This area is evaluated as a single unit since it is not large enough to support multiple locations.
- For the residential wood harvester, three study areas will be studied. The se shall be in the primary downwind direction (north-northeast) from the mine site. Each area shall be accessible by truck, and shall contain at least 5 trees within 50 yards of the road that are suitable for harvesting (this designation is made by the USFS). Tentative locations are shown in Figure 4-2. These areas will be referred to as "Near" (Area 10), "Middle" (Area 7), and "Far" (Area 2).
- For the USFS management worker and the USFS firefighter scenarios, the same three study areas (Near, Middle, and Far) used for wood harvesting shall be used. As above, these three areas are selected to provide spatial representativeness as a function of distance, which is expected to be correlated with the level of LA contamination in environmental media.
- For exposure to smoke during simulated wildfires, two large slash piles that exist in OU3 are identified as the most appropriate locations for simulated wildfires. These slash piles are located approximately at the 5-mile point on the mine haul road, about 100 yards on the northern side of the tailings pile (see Figures 4-3 and 4-4).
- The sampling locations for ambient air monitors to be activated in the event of a forest fire in the FSRZ of OU3 are: 1) the CDM office building in Libby; 2) the USFS Canoe Gulch Ranger Station on Highway 37; 3) the McGillvary Campground on the west shore of Lake Koocanusa; and 4) a mobile monitor to be located downwind of the fire.

In the event that any changes in samples locations are needed for reasons of safety or implementability, the revisions in the locations of study areas will be specified in a modification to this SAP.

Optimizing Sample Number

As discussed in Step 6 of the DQO process for the Phase IV study, one data quality objective is to limit false positive decision errors such that, if the risk associated with the mean of a data set is < ½ the level of concern but the risk estimate based on the 95UCL is above EPA's level of concern, then the ratio of the 95UCL to the mean should not exceed a factor of about 3. As discussed in EPA (2009a), the ratio of the 95UCL to the true mean depends on a large number of factors, the most important of which are the number of samples and the degree of between-sample variability. If the between-sample variability is low (e.g., geometric standard deviation [GSD] ≤ 3), then the number of samples needed to ensure the risk estimate based on the 95UCL is within a factor about 3 of the risk estimate based on the mean is estimated to be 10 to 15. However, if the GSD is larger, then the number of samples needed is likely on the order of at least 25 to 50, depending on the size of the GSD.

At present, data are not available to estimate how close the mean concentration of LA in ABS air is to a level of human health concern for the scenarios to be evaluated in Phase IV, or on the magnitude of the underlying variability. In the absence of such data, the minimum number of samples to be collected and analyzed in this effort for each scenario is 10 per ABS area per script. This should be sufficient to support decision making at each area if the between-sample variability is not too large and if the observed mean concentration is not too close to a decision threshold. Additional sampling may be needed to support decision-making in cases where the data are variable and/or are near a decision threshold.

In order to minimize health and safety concerns, a different approach will be taken to evaluate exposure of USFS fire fighters to LA released in smoke from burning trees and duff. As described in Attachment A, exposure to smoke from a wildfire will be evaluated by collecting personal air samples during the burning of two large slash piles in OU3. During each fire, 4 personal air samples will be collected for a total of 8 personal air samples per fire (16 total).

For the characterization of exposure of area residents to smoke from a forest fire, samples of ambient air will be collected every time a fire of significant size occurs within the FSRZ. The number of samples this will generate is unknown.

Selection of Target Analytical Sensitivity

The level of analytical sensitivity needed to ensure that analysis of ABS air samples from OU3 will be adequate is derived by finding the concentration of LA in ABS air that might be of

potential concern, and then ensuring that if an ABS sample were encountered that had a true concentration equal to that level of concern, it would be quantified with reasonable accuracy.

At present, EPA has not developed a quantitative procedure for evaluating non-cancer risks associated with inhalation exposure to asbestos, but has developed a method for quantification of cancer risk (EPA 2008d). The basic equation is:

$$\text{Risk} = C \cdot TWF \cdot IUR_{a,d}$$

where:

C = Average concentration of asbestos structures in inhaled air (s/cc)
TWF = Time weighting factor to account for less than continuous exposure (unitless)
$IUR_{a,d}$ = Inhalation unit risk (s/cc)-1 based on continuous exposure beginning at age "a" and continuing for duration "d" years. EPA (2008d) provides a table (Table E-4) of unit risk values for a range of start ages and exposure durations.

It is important to recognize that the value of C must be expressed in units of Phase Contrast Microscopy (PCM) f/cc. This is because the current risk model for estimation of cancer risk from inhalation exposure to asbestos (EPA 2008d) is based on cumulative exposure expressed as PCM f/cc-yrs. The concentration of PCM fibers in ABS air could be measured directly using phase contrast microscopy, but EPA believes it is better to measure the concentration of total LA fibers using TEM, and then to compute the number of fibers observed in TEM that meet the counting requirements for PCM[1]. These are referred to as PCM-equivalent (PCME) fibers. The concentration of PCME fibers (measured by TEM) is an estimate of the concentration value that would have been obtained if the sample were analyzed by PCM. Since the number of PCME fibers released under the scenarios being evaluated under Phase IV is not yet known, for the purpose of determining target analytical sensitivity, the number of PCME fibers is based on the average ratio of PCME to total LA fibers measured in other samples collected from the site. This is referred to as the "risk-based fraction" (RBF), and the calculation is performed as follows:

$$C(\text{PCME}) = C(\text{total LA}) \cdot RBF_{PCME}$$

Combining the equations above and re-arranging to solve for the concentration of LA that corresponds to a specified risk level yields the following:

$$C(\text{total LA}) = \text{Specified Risk} / [\, RBF_{PCME} \cdot TWF \cdot IUR_{a,d}]$$

[1] In the PCM method, a fiber is counted if it has a length of 5 um or longer and an aspect ratio of at least 3:1. Although there is no thickness rule, particles thinner than about 0.25 um are not usually detectable by PCM. Hence, the counting rules for PCME are: length ≥ 5, aspect ratio ≥ 3, thickness > 0.25.

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For convenience, the concentration of LA that corresponds to a specified risk level is referred to as a Risk-Based Concentration (RBC).

Table 4-1 (Panel A) identifies the exposure parameters that have been selected to calculate the RBC for each of the exposure scenarios being investigated in Phase IV. These exposure parameters are intended to be conservative, which helps ensure that the target analytical sensitivity will be adequate. Exposure parameters used in the final human health risk assessment may be different than those used here.

Table 4-1 (Panel B) shows the calculation of the RBC for each exposure scenario. The value of the RBF is based on available data from previous ABS studies in OU3 indicated that 36 out of 71 total LA structures were PCME (RBF = 0.51). This value is similar to what has been observed in samples collected in studies in OU4. The target risk employed in these calculations is 1E-05 in all cases. It is important to emphasize that choice of 1E-05 as the "specified risk" is not a risk management decision about the need for remedial action. Rather, this choice is strictly for the purposes of deriving an analytical sensitivity that will be adequate for the OU3 Phase IV ABS program. All actual evaluations of health risk will be performed by EPA in the risk assessment for OU3, and all risk management decisions will be documented in the Record of Decision.

Table 4-1 (Panel C) calculates the target sensitivity for each scenario, based on the RBC values derived in Panel B. In all cases, the target sensitivity is set so that, on average, about 5 LA structures would be counted in a sample whose true concentration was equal to the RBC. This level of analytical sensitivity should be sufficient to allow reliable quantitation of ABS samples that approach or exceed a risk level of about 1E-05.

Table 4-1 (Panel D) shows the estimated number of grid opening that may be required to achieve the specified target sensitivity for each scenario.

Optimizing the Sample Collection Strategy

Two key variables that may be adjusted during collection of air samples are sampling duration and pump flow rate. The product of these two variables determines the amount of air drawn through the filter, which in turn is an important factor in the analytical cost and feasibility of achieving the target analytical sensitivity (see above). In general, longer sampling times are preferred over shorter sampling times because a) longer time intervals are more likely to yield representative measures of the average concentration (as opposed to short-term fluctuations), and b) longer collection times are associated with higher volumes, which makes it easier to achieve the target analytical sensitivity. Likewise, higher flow rates are generally preferred over lower flow rates because high flow results in high volumes drawn through the filter over shorter sampling times.

However, there is a limit to how much air can be drawn through a filter. In cases where the air being sampled contains a significant level of dust, high air volumes may lead to overloading of the filter with dust particles. In this event, the filter cannot be examined directly, but must undergo an "indirect preparation" in which the material on the filter is suspended in water and only a fraction is re-deposited on a "secondary" filter, such that the secondary filter is not overloaded. In some cases, indirect preparation of air samples may alter (usually increase) the observed concentration of asbestos in air samples. Region 8 has reviewed published studies on this topic (see HEI-AR 1991 and Breysse 1991 for reviews), and interprets the data to indicate that, in contrast to what is usually observed in the case of chrysotile asbestos, effects of indirect preparation of samples containing amphibole asbestos are generally small (e.g., Bishop et al. 1978, Sahle and Laszlo 1996). However, because of the possibility that indirect preparations might cause changes (increases) in measured LA concentrations, EPA has determined that, for this project, it is desirable to seek to limit the volume of air drawn through the filter to an amount that approaches but does not cause overloading in order to minimize the need for use of indirect preparations.

Based on experience gained from implementation of the OU3 Phase III recreational visitor ABS sampling effort, it was found that most ABS samples were overloaded when collected using the originally planned sampling conditions (180 minutes at a flow of 8 L/minute). Based on this finding, the original ABS sampling protocol for the recreational visitor scenario (EPA 2009a) was revised to divide the composite activity into three sub-activities, and to reduce the sampling time and pump flow rate for each (EPA 2009c). Each individual wore two sampling pumps which operated at a flow rate of either 2 L/min (low flow) or 4 L/min (high flow). Whenever possible, the filter from the high flow pump was selected for analysis. In cases where the high flow filter was overloaded, then the low flow filter was analyzed. Average values for Phase III samples are as follows:

Activity	Average Time (min)	Average Flow (L/min)	Average Vol. (L)
ATV Riding	20	3.76	75
Hiking	80	3.00	240
Fire building	35	2.82	99

Based on this experience, the strategy for collecting Phase IV ABS samples shall be similar to that used in the revised Phase III approach (EPA 2009c), where each individual wears two pumps, operated at 2 L/min and 4 L/min. Sampling times should be adjusted so that the majority of the high flow filters approach but do not exceed overloading. In cases when overloading does occur, then the low flow sample should be analyzed.

5.0 SAMPLING PROGRAM

Table 5-1 provides an overview of the Phase IV ABS sampling design. Key elements are discussed in greater detail below.

5.1 ABS Scripts

As discussed above, individuals will engage in a timed series of different activities to generate ABS samples that are representative of a range of realistic activities that may be performed by each population being assessed. The scripts are presented in Attachment A.

5.2 Sampling Areas

Sampling areas for ABS data collection and for smoke monitoring during naturally occurring wildfires are shown in Figure 4-2.

5.3 Sampling Schedule

Recreational Visitor Along Rainy Creek Scenario
The recreational scenario along lower Rainy Creek will be implemented in middle to late summer (late July through early September) when flow in Rainy Creek is low, to maximize the chance of hikers being exposed to dried sediment. Samples should be collected on warm and dry days and should not be collected within 24 hours of a rain event.

Residential Wood Harvester Scenario
Similar to the recreational visitor, it is expected that wood harvesting by area residents will occur mainly when the weather is warm and snow cover is minimal or absent, with a majority of the activity occurring in late summer or early fall. Based on this, the residential wood harvester scenario will be implemented in middle to late summer (late July through early September) to optimize the conditions for releasing LA. Samples should be collected on warm and dry days and should not be collected within 24 hours of a rain event.

USFS Forest Management Scenarios
It is expected that most routine forest management activities performed by USFS staff in OU3 will occur when the weather is warm and snow cover is minimal or absent. Based on this, the time window for collection of ABS samples for the USFS forest management work is approximately June 1 through September 30.

Fireline Construction Scenarios
Exposure of USFS firefighters may occur at any time of year that a fire occurs. Based on USFS records, the highest frequency of fires in the Kootenai national Forest occurs in the months of

July, August, and September. Based on this, the time window for collecting data for the cutting of firelines (both by hand and using heavy equipment) will be between July 1 and September 31.

Simulated Wildfire Scenario

For exposure to smoke from simulated wildfires, it is vital that the fires occur under conditions when risk of the fire spreading is minimal. Consequently, these scenarios will be implemented under wet or snowy conditions. The choice of time for these events will be closely coordinated with the USFS and will be subject to USFS approval. On the day(s) selected for the simulated wildfires, one fire will be ignited in the morning, and the second fire will be ignited in the afternoon. This is because meterological conditions often vary significantly between morning and afternoon, and this can influence the behavior of the smoke plume.

5.3 Activity Patterns within Each Area

In order to maximize the representativeness of the samples over space as well as time, to the extent feasible, the exact locations of the ABS activities within the ABS areas should vary from event to event. In order to create a record of the exact locations within each ABS area that were evaluated, each person will carry a global positioning system (GPS) unit programmed to automatically record location (± about 5 meters) once every minute. Field crews will download this electronic record at the end of each ABS event. The Field Quality Control Officer and the Field Team Leader will be responsible for ensuring that ABS events are conducted at different locations within the ABS area. Any questions about the representativeness of sampling locations will be directed to the EPA Remedial Project Manager (RPM) or resolution. At the completion of the Phase IV ABS program (all ABS events completed at all areas), the tracks from all ABS events at each ABS areas will be superimposed to create maps of the locations that were evaluated at each area across the entire sampling investigation. These maps shall be submitted to EPA and MDEQ.

5.4 Personal Air Sampling Protocol

All ABS air samples will be collected in accord with SOP ABS-LIBBY-OU3 (Rev. 0). A copy of this standard operating procedure (SOP) is presented in Attachment B. All air samples will be collected using cassettes that contain a 25 mm diameter mixed cellulose ester (MCE) filter with a pore size of 0.8 μm. As discussed above, during initial sampling events, pumps will be set to a flow rate of either 2 L/min (low flow) or 4 L/min (high flow). Sampling durations are specified in the scripts for each ABS scenario (see Attachment A). These flow rates and sampling times may be revised as experience is gained on the degree of loading on the ABS filters.

A battery-powered air sampling pump (SKC model AirChek XR5000™ (0.005-5.0 L/min) or similar) will be worn by the participant. The monitoring cassette will be attached to the pump via a plastic tube, and affixed to the shoulder of the participant such that the cassette is within the breathing zone. The breathing zone can be visualized as a hemisphere approximately 6 to 9

inches around an individual's face. The top cover from the cowl extension on the sampling cassette shall be removed ("open-face") and the cassette oriented face down.

Each air sampling pump will be calibrated at the start of each ABS sampling period using a rotameter that has been calibrated to a primary calibration source. For pre-sampling purposes, calibration will be considered complete when the measured flow is within ±5% of the target flow, as determined by the mean of three measurements.

As noted in the ABS script (see Attachment A), the pumps should be turned on at the beginning of each ABS event, and left to run for the duration of the script or activity as specified. Because flow may tend to change during the ABS script, flow will also be measured and recorded at the completion of the script.

To prevent potential cross-contamination, each rotameter used for field calibration will be transported to and from each sampling location in a sealed zip-top plastic bag. The cap used at the end of the rotameter tubing will be replaced each morning after it is used.

5.5 Collection of Bark Samples from Slash Piles

Before ignition of simulated wildfires at either of the large slash piles located in OU3, it is necessary to collect bark samples from each slash pile in order to characterize the level of LA contamination in the pile.

Bark samples will be collected and prepared for analysis in basic accord with SOP TREE-LIBBY-OU3 (Rev. 1). Because the trees in the slash pile are no longer standing, samples should be collected about 4-5 feet above the cut base of trees that are approximately 8 inches or larger in diameter. A total of 8 bark samples shall be collected from each pile. These shall be collected from 8 different trees, located at representative random locations in the slash pile. Initially, 2 samples from each pile will be analyzed to verify the presence of LA in the tree bark. More samples may be analyzed if the initial results do not indicate the presence of LA.

5.6 Collection of Air Samples During Wildfires in OU3

As noted above, EPA (2009b) established three monitoring stations to measure LA in air during significant fire events in OPU3, including a) the CDM office building in Libby, b) the campground east of OU3 at McGillvary Access, and c) the USFS ranger station along Highway 37. This plan has been amended to add a fourth monitoring location, downwind of the fire location. This revised plan is provided at Attachment D.

5.7 Field Documentation

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All data associated with each ABS event shall be recorded on a field sample data sheet (FSDS) specifically designed for ABS activities in OU3. These FSDS forms are provided in the respective OU3 SOPs.

6.0 LABORATORY ANALYSIS REQUIREMENTS

6.1 Laboratory Qualifications

All laboratories that analyze samples of ABS air or tree bark for asbestos as part of this project must participate in and have satisfied the certification requirements in the last two proficiency examinations from the National Institute of Standards and Technology/National Voluntary Laboratory Accreditation Program (NVLAP). Laboratories must also have demonstrated proficiency by successful analysis of Libby-specific performance evaluation samples and/or standard reference materials and must participate in the on-going laboratory QA program for the Libby OU3 project.

6.2 Analytical Method and Counting Rules

All samples of air and bark collected during Phase IV sampling will be submitted for asbestos analysis using transmission electron microscopy (TEM) in accord with the International Organization for Standardization (ISO) 10312 method (ISO 1995) counting protocols, with all applicable Libby site-specific laboratory modifications, including the most recent versions of modifications LB-000016, LB-000019, LB-00028, LB-000030, LB-000066, and LB-000085 (see Attachment C). All amphibole structures (including not only LA but all other asbestos types as well) that have appropriate Selective Area Electron Diffraction (SAED) patterns and Energy Dispersive X-Ray Analysis (EDXA) spectra, and having length greater than or equal to 0.5 µm and an aspect ratio (length:width) $\geq$ 3:1, will be recorded on the Libby site-specific laboratory bench sheets and electronic data deliverable (EDD) spreadsheets. Data recording for chrysotile, if observed, is not required.

6.3 Stopping Rules

The target analytical sensitivities for ABS samples for each scenario are shown in Table 4-1.

The target analytical sensitivity for tree bark samples is 10,000 cm^{-2}.

For all ABS and tree bark field samples, evaluate each sample until one of the following is achieved:

- A minimum of 2 grid openings (GOs) in each of 2 grids has been examined.
- The target sensitivity is achieved.
- 50 LA structures are observed
- An area of 1.0 mm^2 has been examined (approximately 100 GOs)

When one of these goals is achieved, complete the final GO and stop.

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For all ABS blanks (i.e., lot blanks, field blanks, and lab blanks), evaluate an area of 0.1 mm^2 (approximately 10 GOs) and stop.

7.0 QUALITY CONTROL

Quality Control (QC) consists of the collection of data that allow a quantitative evaluation of the accuracy and precision of the field data collected during the project. QC samples that will be collected during ABS sampling include both field-based and laboratory-based QC samples.

7.1 Field-Based Quality Control Samples

Lot Blanks

Before any air cassettes may be used for asbestos sampling, the lot must be determined to be asbestos free. This will be accomplished by selecting 2 lot blanks at random from the group of cassettes to be used for collection of ABS air samples. Each lot blank will be submitted for TEM analysis as described above. Once the lot is confirmed to be asbestos free (i.e., both lot blanks are non-detect after evaluation of an area of 0.1 mm^2), that lot may be placed into use for sampling.

Field Blanks

A field blank for air shall be prepared by removing the sampling cassette from the box, opening the cassette to the air in the area where the investigative samples will be taken, then closing the cassette and packaging for shipment and analysis. Field blanks for ABS air will be collected at a rate of 1 per ABS sampling round. The ABS sampling location where the field blank is generated should be selected at random, choosing a new location (ABS area) for each field blank. This strategy will generate a total of 10 field blanks.

7.2 Laboratory-Based Quality Control Samples for Asbestos Analysis by TEM

The QC requirements for TEM analyses of air samples at the Libby site are patterned after the requirements set forth by NVLAP. There are three types of laboratory-based QC analyses that are performed for TEM. Each of these is described below.

Lab Blank - This is an analysis of a TEM grid that is prepared from a new, unused filter in the laboratory and is analyzed using the same procedure as used for field blank samples.

Recounts - A recount is an analysis where TEM grid openings are re-examined after the initial examination. The type of recount depends upon who is performing the re-examination. A *Recount Same* (RS) describes a re-examination by the same microscopist who performed the initial examination. A *Recount Different* (RD) describes a re-examination by a different microscopist within the same laboratory than who performed

the initial examination. An *Interlab* (IL) describes a re-examination by a different microscopist from a different laboratory.

Repreparation - A repreparation is an analysis of a TEM grid that is prepared from a new section of filter as was used to prepare the original grid(s). Typically, this is done within the same laboratory as did the original analysis, but a different laboratory may also prepare grids from a new piece of filter.

For this project, the frequency of these laboratory-based QC samples will be as follows:

QC Sample Type	QC Sample Rate	Estimated Number (a)
Lab Blank	1% (1 per 100)	3
Recount Different	2% (1 per 50)	6
Interlab	2% (1 per 50)	6
Repreparation	2% (1 per 50)	6

(a) Assumes approximately 300 ABS samples will be analyzed during Phase IV-A

The list of samples for Recount Different, Interlab, and Repreparation will be selected by SRC and provided to the laboratory by the EPA RPM after the results of the original sample analyses have become available.

The most recent version of laboratory modification LB-000029 (see Attachment C) summarizes the acceptance criteria and corrective actions for TEM laboratory QC analyses that will be used to assess data quality.

8.0 SAMPLE HANDLING AND DOCUMENTATION

8.1 Field Procedures

8.1.1 Sample Documentation and Identification

Data regarding each sample collected as part of Phase IV sampling activities will be documented in accord with OU3 SOP No. 9 using Libby OU3-specific FSDS forms. At the time of collection, each sample will be labeled with a unique 5-digit sequential identification (ID) number. The sample IDs for all samples collected as part of Phase IV sampling activities will have a prefix of "P4" (e.g., P4-12345), unless specified otherwise. Information on whether the sample is representative of a field sample or a field-based QC sample (e.g., field blank, field duplicate/split) will be documented on the FSDS.

Each field sampling team will maintain a field log book. The log book shall record all potentially relevant information on sampling activities and conditions that are not otherwise captured on the FSDS forms. Examples of the type of information to be captured in the field log include:

- Names of team members
- Current and previous weather conditions
- Field sketches
- Physical description of the location relative to permanent landmarks
- Number and type of samples collected
- Any special circumstances that influenced sample collection
- Any deviations from sampling SOPs
- For ABS samples, the location description (what trails and areas) the ABS activities were performed in

As necessary for sample collection and location documentation, photographs will be taken using a digital camera. GPS coordinates will be recorded for all sampling locations on the FSDS form. A flag, stake or pole identifying the sampling station will be placed at or near the location for future identification.

8.1.2 Handling Filter Cassettes

All filter cassettes collected during the Phase IV-A effort will be handled as specified in SOP ABS-LIBBY-OU3 (Rev. 0).

8.1.3 Holding Times

There are no holding time requirements for the analysis of asbestos.

8.1.4 Chain of Custody and Shipment

Field sample custody and documentation will follow the requirements described in OU3 SOP No. 9. Sample packaging and shipping will follow the requirements described in OU3 SOP No. 8.

A chain-of-custody (COC) form specific to the Libby OU3 sampling shall accompany every shipment of samples to the analytical laboratory. The purposes of the COC form are: a) to establish the documentation necessary to trace possession from the time of collection to final disposal, and b) to identify the type of analysis requested. All corrections to the COC record will be initialed and dated by the person making the corrections. Each COC form will include signatures of the appropriate individuals indicated on the form. The originals will accompany the samples to the laboratory and copies documenting each custody change will be recorded and kept on file. One copy of the COC form will be kept by field personnel.

All required paper work, including sample container labels, COC forms, custody seals and shipping forms will be fully completed in indelible ink (or printed from a computer) prior to shipping of the samples to the laboratory. Shipping to the appropriate laboratory from the field or sample storage will occur through overnight delivery.

All samples that may require special handling by laboratory personnel to prevent potential exposure to LA or other hazardous substances will be clearly labeled.

8.2 Laboratory Procedures

8.2.1 Chain of Custody

Upon sample receipt, the laboratories will implement the following procedures:

- A sample custodian will be designated.
- Each sample shipment will be inspected by the sample custodian to assess the condition of the shipping container and the individual samples. The enclosed COC form will be reviewed and cross-referenced with all the samples in the shipment. Any discrepancies or abnormalities in samples will be noted and the EPA Project Manager or the appropriate delegate will be promptly notified. The EPA Project Manager shall be notified by telephone at (303) 312-6579 or email at lavelle.bonita@epa.gov.
- The COC form will be signed by the sample custodian and placed in the project file.
- Sample storage will be secured in the appropriate environment (i.e., refrigerated, dry, etc.), sample storage records and intra-laboratory sample custody records will be maintained, and sample disposal and disposal date will be properly documented.

- Internal COC procedures will be followed by logging and assigning a unique laboratory sample number to each sample upon receipt (this number identifies the sample through all further handling at the laboratory).
- Internal logbooks and records will maintain the COC throughout sample preparation, analysis, and data reporting. These records will be kept in the project files.
- The original COC form will be returned to the Project QA Officer with the resulting data report from the laboratory.

Chain-of-custody will be maintained until final disposition of the samples by the laboratory and acceptance of analytical results.

8.2.2 Documentation and Records

Data reports will be submitted to EPA's technical contractor (SRC) in accordance with the procedures described in Section 8.2.3 below. Data reports shall include a case narrative that briefly describes the number of samples, the analyses, and any analytical difficulties or QA/QC issues associated with the submitted samples. The data report will also include signed COC forms, analytical data summary report pages, and a summary of laboratory QC sample results and raw data, where applicable. Raw data are to consist of instrument preparation and calibration logs, instrument printouts of field sample results, laboratory QC sample results, calibration and maintenance records, COC check in and tracking, raw data count sheets, spectra, micrographic photos, and diffraction patterns.

8.2.3 Data Deliverables

Asbestos data generated during this project will be entered into Libby-specific EDD spreadsheets by appropriately trained data entry staff. The data will include all relevant field information regarding each environmental sample collected, as well as the analytical results provided by the laboratory. Analytical results will include the structure-specific data for all TEM analyses. All data entry will be reviewed and validated for accuracy by the laboratory data entry manager or appointed delegate.

All asbestos EDDs will be submitted to EPA's technical contractor (SRC) electronically. Whenever possible, data files should be transmitted by e-mail to the following address:

LibbyOU3@srcinc.com

When files are too large to transmit by e-mail, they should be provided on compact disk to the following address:

Lynn Woodbury
SRC, Inc.

999 18th Street, Suite 1975
Denver CO 80202
(303) 357-3127

All original data records (both hard copy and electronic) will be cataloged and stored in their original form until otherwise directed by the Project Manager. At the termination of Phase IV, all original data records will be provided to the EPA Project Manager in a format specified by EPA for incorporation into the OU3 project files.

8.2.4 Archival and Final Disposition

All sample materials, including filters, grids, and cassettes will be maintained in storage at the laboratory unless otherwise directed by EPA. When authorized by EPA, the laboratory will be responsible for proper disposal of any remaining samples, sample containers, shipping containers, and packing materials in accordance with sound environmental practice, based on the sample analytical results. The laboratory will maintain proper records of waste disposal methods, and will have disposal company contracts on file for inspection.

9.0 DATA MANAGEMENT

9.1 Data Management Applications

All data generated as part of the Phase IV sampling will be maintained in an OU3-specific Microsoft® Access database. This will be a relational database with tables designed to store information on station location, sample collection details, preparation and analysis details, and analytical results. Results will include all asbestos data, including detailed structure attributes for TEM analyses.

As needed, EPA staff and designated contractors will develop tabular and graphical data summaries, perform statistical analyses, and generate maps using commercially-available applications such as Microsoft® Access and Excel and ArcGIS®.

9.2 Roles and Responsibilities for Data Flow

9.2.1 Field Personnel

W.R. Grace Contractors will perform all Phase IV sample collection in accordance with the project-specific sampling plan and SOPs presented above. In the field, sample details will be documented on hard copy media-specific FSDS forms and in field log books (see Section 6.1.1). COC information will be documented on hard copy forms (see Section 6.1.4). FSDS and COC information will be manually entered into a field-specific[2] OU3 database using electronic data entry forms. Use of electronic data entry forms ensures the accuracy of data entry and helps maintain data integrity. For example, data entry forms utilize drop-down menus and check boxes whenever possible. These features allow the data entry personnel to select from a set of standard inputs, thereby preventing duplication and transcription errors and limiting the number of available selections (e.g., media types). In addition, entry into a database allows for the incorporation of data entry checks. For example, the database will allow a unique sample ID to only be entered once, thus ensuring that duplicate records cannot be created.

Entry of FSDS forms and COC information will be completed weekly, or more frequently as conditions permit. Copies of all FSDS forms, COC forms, and field log books will be scanned and posted in portable document format (PDF) to a project-specific file transfer protocol (FTP) site weekly. This FTP site will have controlled access (i.e., user name and password are required) to ensure data access is limited to appropriate project-related personnel. File names for scanned FSDS forms, COC forms, and field log books will include the sample date in the format YYYYMMDD to facilitate document organization (e.g., FSDS_20090831.pdf).

[2] The field-specific OU3 database is a simplified version of the master OU3 database. This simplified database includes only the station and sample recording and tracking tables, as well as the FSDS and COC data entry forms.

After FSDS data entry is completed, a copy of the field-specific OU3 database will be posted to the project-specific FTP weekly, or more frequently as conditions permit. The field-specific OU3 database posted to the FTP site will include the post date in the file name (e.g., FieldOU3DB_20090831.mdb).

9.2.2 Laboratory Personnel

Each of the laboratories performing analyses for the Phase IV sampling are required to utilize all applicable Libby-specific Microsoft® Excel spreadsheets for data recording and electronic submittals (see Section 8.2.3). Upon completion of the appropriate analyses, EDDs will be transmitted via email to a designated email distribution list within the appropriate turn-around-time. Hard copies of all analytical laboratory data packages will be scanned to a PDF and either posted to the project-specific FTP site or emailed to a designated email distribution list. File names for scanned analytical laboratory data packages will include the laboratory name and the job number to facilitate document organization (e.g., LabX_12365-A.pdf).

The email distribution list is as follows:

LibbyOU3@srcinc.com
Lavelle.bonita@epa.gov
Robert.r.marriam@grace.com

9.2.3 Database Administrators

Day-to-day operations of the master OU3 database will be under the control of EPA contractors. The primary database administrator will be responsible for sample tracking, uploading new data, performing error checks, and making any necessary data corrections. New records will be added to the master OU3 database within an appropriate time period of FSDS and/or EDD receipt.

Incremental backups of the master OU3 database will be performed daily Monday through Thursday, and a full backup will be performed each Friday. The full backup tapes will be stored off-site for 30 days. After 30 days, the tape will be placed back into the tape library to be overwritten by another full backup.

Each Friday, a copy of the master OU3 database will be posted to a project-specific FTP site to allow timely access to results by data users. The master OU3 database posted to the FTP site will include the post date in the file name (e.g., MasterOU3DB_20090831.mdb).

9.3 Data Storage

All original data records (both hard copy and electronic) will be cataloged and stored in their original form until otherwise directed by the EPA Project Manager. At the termination of this

project, all original data records will be provided to the EPA Project Manager in a format specified by EPA for incorporation into the site project files.

10.0 ASSESSMENT AND OVERSIGHT

Assessments and oversight reports to management are necessary to ensure that procedures are followed as required and that deviations from procedures are documented. These reports also serve to keep management current on field activities. Assessment, oversight reports, and response actions are discussed below.

10.1 Assessments

10.1.1 Field Oversight

All individuals who collect samples during field activities will be provided a copy of this SAP and will be required to participate in a pre-sampling readiness review meeting to ensure that methods and procedures called for in this SAP and associated SOPs are understood and that all necessary equipment is on hand. EPA may perform random and unannounced field audits of field sampling collection activities, as may be deemed necessary.

10.1.2 Laboratory Oversight

All laboratories selected for analysis of samples for asbestos will be part of the Libby analytical team for OU3. These laboratories have all demonstrated experience and expertise in analysis of LA in environmental media, and all are part of an on-going site-specific quality assurance program designed to ensure accuracy and consistency between laboratories. These laboratories are audited by EPA and NVLAP on a regular basis. Additional laboratory audits may be conducted upon request from the EPA, as may be needed.

10.2 Response Actions

If any inconsistencies or errors in field or laboratory methods and procedures are identified, response actions will be implemented on a case-by-case basis to correct quality problems. All response actions will be documented in a memo to the EPA RPM for OU3 at the following address:

Bonita Lavelle
U.S. EPA, Region 8
1595 Wynkoop Street
Denver, CO 80202-1129
E-mail: lavelle.bonita@epa.gov

Any problems that cannot be corrected quickly through routine procedures may require implementation of a corrective action request (CAR) form.

10.3 Reports to Management

Field and analytical staff will promptly communicate any difficulties or problems in implementation of the SAP to EPA, and may recommend changes as needed. If any revisions to this SAP are needed, the EPA RPM will approve these revisions before implementation by field or analytical staff.

11.0 DATA VALIDATION AND USABILITY

11.1 Data Validation and Verification Requirements

Data validation consists of examining the sample data package(s) against pre-determined standardized requirements. The validator may examine, as appropriate, the reported results, QC summaries, case narratives, COC information, raw data, initial and continuing instrument calibration, and other reported information to determine the accuracy and completeness of the data package. During this process, the validator will verify that the analytical methodologies were followed and QC requirements were met. The validator may recalculate selected analytical results to verify the accuracy of the reported information. Analytical results will then be qualified as necessary.

Data verification includes checking that results have been transferred correctly from laboratory data printouts to the laboratory report and to the EDD. Some of the data verification checks are performed as a function of built-in quality control checks in the Libby-specific data entry spreadsheets. Additional verifications of field and analytical results will be performed at a frequency of 10%. This initial rate may be revised as samples are analyzed and results evaluated. Data validation, review, and verifications must be performed on sample results before distribution to the public for review.

11.2 Reconciliation with Data Quality Objectives

Once all samples have been collected and analytical data has been generated, data will be evaluated to determine if DQOs were achieved. Evaluation of the Phase IV data will include a qualitative and quantitative review of all QC samples and all deviations from sampling and analysis plans described in this report, along with conclusions regarding the reliability of the data for their intended use. Results of the data quality evaluation will in general be reported in the Baseline Human Health Risk Assessment, the Baseline Ecological Risk Assessment, and the final RI Report for OU3.

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EXHIBIT A

EXHIBIT 2